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**PART G-3**  
**FIRE SUPPRESSION EQUIPMENT**

WAC

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**WAC 296-24-592 Portable fire extinguishers.** All sections of this chapter which include WAC 296-24-592 in the section number apply to portable fire extinguishers.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-592, filed 12/24/81.]

**WAC 296-24-59201 Scope and application.** The requirements of this section apply to the hydrostatic testing of portable fire extinguishers provided for the use of employees.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-59201, filed 05/09/01, effective 09/01/01.  
Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-59201, filed 12/24/81.]

**WAC 296-24-59212 Hydrostatic testing.**

- (1) In addition to an external visual examination, the employer shall assure that an internal examination of cylinders and shells to be tested is made prior to the hydrostatic tests.
- (2) The employer shall ensure that portable fire extinguishers are hydrostatically tested whenever they show new evidence of corrosion or mechanical injury.
- (3) The employer shall assure that hydrostatic tests are performed on extinguisher hose assemblies which are equipped with a shut-off nozzle at the discharge end of the hose. The test interval shall be the same as specified for the extinguisher on which the hose is installed.
- (4) The employer shall assure that carbon dioxide hose assemblies with a shut-off nozzle are hydrostatically tested at 1,250 psi (8,620 kPa).
- (5) The employer shall assure that dry chemical and dry powder hose assemblies with a shut-off nozzle are hydrostatically tested at 300 psi (2,070 kPa).
- (6) Hose assemblies passing a hydrostatic test do not require any type of recording or stamping.
- (7) The employer shall assure that hose assemblies for carbon dioxide extinguishers that require a hydrostatic test are tested within a protective cage device.
- (8) The employer shall assure that carbon dioxide extinguishers and nitrogen or carbon dioxide cylinders used with wheeled extinguishers are tested every five years at 5/3 of the service pressure as stamped into the cylinder. Nitrogen cylinders which comply with 29 CFR 173.34(e)(15) may be hydrostatically tested every ten years.
- (9) The employer shall assure that all stored pressure and Halon 1211 types of extinguishers are hydrostatically tested at the factory test pressure not to exceed two times the service pressure.
- (10) The employer shall assure that acceptable self-generating type soda acid and foam extinguishers are tested at 350 psi (2,410 kPa).
- (11) Air or gas pressure may not be used for hydrostatic testing.
- (12) Extinguisher shells, cylinders, or cartridges which fail a hydrostatic pressure test, or which are not fit for testing shall be removed from service and from the workplace.
- (13)
  - (a) The equipment for testing compressed gas type cylinders shall be of the water-jacket type. The equipment shall be provided with an expansion indicator which operates with an accuracy within one percent of the total expansion or 0.1 cc (.1mL) of liquid.
  - (b) The equipment for testing noncompressed gas type cylinders shall consist of the following:

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**WAC 296-24-59212 (Cont.)**

- (i) A hydrostatic test pump, hand or power operated, capable of producing not less than one hundred fifty percent of the test pressure, which shall include appropriate check valves and fittings;
- (ii) A flexible connection for attachment to fittings to test through the extinguisher nozzle, test bonnet, or hose outlet, as is applicable; and
- (iii) A protective cage or barrier for personal protection of the tester, designed to provide visual observation of the extinguisher under test.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-59212, filed 05/09/01, effective 09/01/01.]

**WAC 296-24-59215 Appendix A-Portable fire extinguishers.**

- (1) Scope and application. The scope and application of this section is written to apply to three basic types of workplaces. First, there are those workplaces where the employer has chosen to evacuate all employees from the workplace at the time of a fire emergency. Second, there are those workplaces where the employer has chosen to permit certain employees to fight fires and to evacuate all other nonessential employees at the time of a fire emergency. Third, there are those workplaces where the employer has chosen to permit all employees in the workplace to use portable fire extinguishers to fight fires.

The section also addresses two kinds of work areas. The entire workplace can be divided into outside (exterior) work areas and inside (interior) work areas. This division of the workplace into two areas is done in recognition of the different types of hazards employees may be exposed to during fire fighting operations. Fires in interior workplaces, pose a greater hazard to employees; they can produce greater exposure to quantities of smoke, toxic gases, and heat because of the capability of a building or structure to contain or entrap these products of combustion until the building can be ventilated. Exterior work areas, normally open to the environment, are somewhat less hazardous, because the products of combustion are generally carried away by the thermal column of the fire. Employees also have a greater selection of evacuation routes if it is necessary to abandon fire fighting efforts.

In recognition of the degree of hazard present in the two types of work areas, the standards for exterior work areas are somewhat less restrictive in regards to extinguisher distribution. WAC 296-800-300 explains this by specifying which sections apply.

- (2) Portable fire extinguisher exemptions. In recognition of the three options given to employers in regard to the amount of employee evacuation to be carried out, the standards permit certain exemptions based on the number of employees expected to use fire extinguishers.

Where the employer has chosen to totally evacuate the workplace at the time of a fire emergency and when fire extinguishers are not provided, the requirements of this section do not apply to that workplace.

Where the employer has chosen to partially evacuate the workplace or the effected area at the time of a fire emergency and has permitted certain designated employees to remain behind to operate critical plant operations or to fight fires with extinguishers, then the employer is exempt from the distribution requirements of this section. Employees who will be remaining behind to perform incipient fire fighting or members of a fire brigade must be trained in their duties. The training must result in the employees becoming familiar with the locations of fire extinguishers. Therefore, the employer must locate the extinguishers in convenient locations where the employees know they can be found. For example, they could be mounted in the fire truck or cart that the fire brigade uses when it responds to a fire emergency. They can also be distributed as set forth in the National Fire Protection Association's Standard No. 10, "Portable Fire Extinguishers."

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**WAC 296-24-59215 (Cont.)**

Where the employer has decided to permit all employees in the workplace to use fire extinguishers, then the entire WISHA standard applies.

- (3) Portable fire extinguisher mounting. Previous standards for mounting fire extinguishers have been criticized for requiring specific mounting locations. In recognition of this criticism, the standard has been rewritten to permit as much flexibility in extinguisher mounting as is acceptable to assure that fire extinguishers are available when needed and that employees are not subjected to injury hazards when they try to obtain an extinguisher.

It is the intent of WISHA to permit the mounting of extinguishers in any location that is accessible to employees without the use of portable devices such as a ladder. This limitation is necessary because portable devices can be moved or taken from the place where they are needed and, therefore, might not be available at the time of an emergency.

Employers are given as much flexibility as possible to assure that employees can obtain extinguishers as fast as possible. For example, an acceptable method of mounting extinguishers in areas where fork lift trucks or tow-motors are used is to mount the units on retractable board which, by means of counterweighting, can be raised above the level where they could be struck by vehicular traffic. When needed, they can be lowered quickly for use. This method of mounting can also reduce vandalism and unauthorized use of extinguishers. The extinguishers may also be mounted as outlined in the National Fire Protection Association's Standard No. 10, "Portable Fire Extinguishers."

- (4) Selection and distribution. The employer is responsible for the proper selection and distribution of fire extinguishers and the determination of the necessary degree of protection. The selection and distribution of fire extinguishers must reflect the type and class of fire hazards associated with a particular workplace.

Extinguishers for protecting Class A hazards may be selected from the following types: Water, foam, loaded stream, or multipurpose dry chemical. Extinguishers for protecting Class B hazards may be selected from the following types: Halon 1301, Halon 1211, carbon dioxide, dry chemicals, foam, or loaded stream. Extinguishers for Class C hazards may be selected from the following types: Halon 1301, Halon 1211, carbon dioxide, or dry chemical.

Combustible metal (Class D hazards) fires pose a different type of fire problem in the workplace. Extinguishers using water, gas, or certain dry chemicals cannot extinguish or control this type of fire. Therefore, certain metals have specific dry powder extinguishing agents which can extinguish or control this type of fire. Those agents which have been specifically approved for use on certain metal fires provide the best protection; however, there are also some "universal" type agents which can be used effectively on a variety of combustible metal fires if necessary. The "universal" type agents include: Foundry flux, Lith-X powder, TMB liquid, pyromet powder, TEC powder, dry talc, dry graphite powder, dry sand, dry sodium chloride, dry soda ash, lithium chloride, zirconium silicate, and dry dolomite.

Water is not generally accepted as an effective extinguishing agent for metal fires. When applied to hot burning metal, water will break down into its basic atoms of oxygen and hydrogen. This chemical breakdown contributes to the combustion of the metal. However, water is also a good universal coolant and can be used on some combustible metals, but only under proper conditions and application, to reduce the temperature of the burning metal below the ignition point. For example, automatic deluge systems in magnesium plants can discharge such large quantities of water on burning magnesium that the fire will be extinguished. The National Fire Protection Association has specific standards for this type of automatic sprinkler system. Further information on the control of metal fires with water can be found in the National Fire Protection Association's *Fire Protection Handbook*.

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**WAC 296-24-59215 (Cont.)**

An excellent source of selection and distribution criteria is found in the National Fire Protection Association's Standard No. 10. Other sources of information include the National Safety Council and the employer's fire insurance carrier.

- (5) Substitution of standpipe systems for portable fire extinguishers. The employer is permitted to substitute acceptable standpipe systems for portable fire extinguishers under certain circumstances. It is necessary to assure that any substitution will provide the same coverage that portable units provide. This means that fire hoses, because of their limited portability, must be spaced throughout the protected area so that they can reach around obstructions such as columns, machinery, etc., and so that they can reach into closets and other enclosed areas.
- (6) Inspection, maintenance and testing. The ultimate responsibility for the inspection, maintenance and testing of portable fire extinguishers lies with the employer. The actual inspection, maintenance, and testing may, however, be conducted by outside contractors with whom the employer has arranged to do the work. When contracting for such work, the employer should assure that the contractor is capable of performing the work that is needed to comply with this standard.

If the employer should elect to perform the inspection, maintenance, and testing requirements of this section in-house, then the employer must make sure that those persons doing the work have been trained to do the work and to recognize problem areas which could cause an extinguisher to be inoperable. The National Fire Protection Association provides excellent guidelines in its standard for portable fire extinguishers. The employer may also check with the manufacturer of the unit that has been purchased and obtain guidelines on inspection, maintenance, and testing. Hydrostatic testing is a process that should be left to contractors or individuals using suitable facilities and having the training necessary to perform the work.

Any time the employer has removed an extinguisher from service to be checked or repaired, alternate equivalent protection must be provided. Alternate equivalent protection could include replacing the extinguisher with one or more units having equivalent or equal ratings, posting a fire watch, restricting the unprotected area from employee exposure, or providing a hose system ready to operate.

- (7) Hydrostatic testing. As stated before, the employer may contract for hydrostatic testing. However, if the employer wishes to provide the testing service, certain equipment and facilities must be available. Employees should be made aware of the hazards associated with hydrostatic testing and the importance of using proper guards and water pressures. Severe injury can result if extinguisher shells fail violently under hydrostatic pressure.

Employers are encouraged to use contractors who can perform adequate and reliable service. Firms which have been certified by the Materials Transportation Board (MTB) of the United States Department of Transportation (DOT), or state licensed extinguisher servicing firms, or recognized by the National Association of Fire Equipment Distributors in Chicago, Illinois, are generally acceptable for performing this service.

- (8) Training and education. This part of the standard is of the utmost importance to employers and employees if the risk of injury or death due to extinguisher use is to be reduced. If an employer is going to permit an employee to fight a workplace fire of any size, the employer must make sure that the employee knows everything necessary to assure the employee's safety.

Training and education can be obtained through many channels. Often, local fire departments in larger cities have fire prevention bureaus or similar organizations which can provide basic fire prevention training programs. Fire insurance companies will have data and information available. The National Fire Protection Association and the National Safety Council will provide, at a small cost, publications that can be used in a fire prevention program.

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**WAC 296-24-59215 (Cont.)**

Actual fire fighting training can be obtained from various sources in the country. The Texas A and M University, the University of Maryland's Fire and Rescue Institute, West Virginia University's Fire Service Extension, Iowa State University's Fire Service Extension and other state training schools and land grant colleges have fire fighting programs directed to industrial applications. Some manufacturers of extinguishers, such as the Ansul Company and Safety First, conduct fire schools for customers in the proper use of extinguishers. Several large corporations have taken time to develop their own on-site training programs which expose employees to the actual "feeling" of fire fighting. Simulated fires for training of employees in the proper use of extinguishers are also an acceptable part of a training program.

In meeting the requirements of this section, the employer may also provide educational materials, without classroom instruction, through the use of employee notice campaigns using instruction sheets or flyers or similar types of informal programs. The employer must make sure that employees are trained and educated to recognize not only what type of fire is being fought and how to fight it, but also when it is time to get away from it and leave fire suppression to more experienced fire fighters.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-59215, filed 05/09/01, effective 09/01/01. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-59215, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-59215, filed 12/24/81.]

**WAC 296-24-602 Standpipe and hose systems.** This section establishes design and installation criteria for standpipe systems.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-602, filed 12/24/81.]

**WAC 296-24-60201 Scope and application.**

- (1) Scope. This section applies to all small hose, Class II and Class III standpipe systems installed to meet the requirements of a particular WISHA standard.
- (2) Exception. This section does not apply to Class I standpipe systems.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60201, filed 12/24/81.]

**WAC 296-24-60203 Protection of standpipes.** The employer shall assure that standpipes are located or otherwise protected against mechanical damage. Damaged standpipes shall be repaired promptly.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60203, filed 12/24/81.]

**WAC 296-24-60205 Equipment.**

- (1) Reels and cabinets. Where reels or cabinets are provided to contain fire hose, the employer shall assure that they are designed to facilitate prompt use of the hose valves, the hose, and other equipment at the time of a fire or other emergency. The employer shall assure that the reels and cabinets are conspicuously identified and used only for fire equipment.
- (2) Hose outlets and connections.
  - (a) The employer shall assure that hose outlets and connections are located high enough above the floor to avoid being obstructed and to be accessible to employees.
  - (b) The employer shall standardize screw threads or provide appropriate adapters throughout the system and assure that the hose connections are compatible with those used on the supporting fire equipment.

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**WAC 296-24-60205 (Cont.)**

- (3) Hose.
- (a) The employer shall assure that every one and one-half inch (3.8 cm) or smaller hose outlet used to meet this standard is equipped with hose connected and ready for use. In extremely cold climates where such installation may result in damaged equipment, the hose may be stored in another location provided it is readily available and can be connected when needed.
  - (b) Standpipe systems installed after July 1, 1982, for use by employees, shall be equipped with lined hose. Unlined hose may remain in use on existing systems. However, after the effective date of this standard, unlined hose which becomes unserviceable shall be replaced with lined hose.
  - (c) Beginning July 1, 1982, the employer shall provide hose of such length that friction loss resulting from water flowing through the hose will not decrease the pressure at the nozzle below 30 psi (210 kPa). The dynamic pressure at the nozzle shall be within the range of 30 psi (210 kPa) to 125 psi (860 kPa).
- (4) Nozzles. Beginning July 1, 1982, the employer shall assure that standpipe hose is equipped with shut-off type nozzles.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60205, filed 12/24/81.]

**WAC 296-24-60207 Water supply.** The minimum water supply for standpipe and hose systems, which are provided for the use of employees, shall be sufficient to provide 100 gallons per minute (6.3 l/s) for a period of at least thirty minutes.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60207, filed 12/24/81.]

**WAC 296-24-60209 Tests and maintenance.**

- (1) Acceptance tests.
- (a) The employer shall assure that the piping of Class II and Class III systems installed after July 1, 1982, including yard piping, is hydrostatically tested for a period of at least two hours at not less than 200 psi (1,380 kPa), or at least 50 psi (340 kPa) in excess of normal pressure when such pressure is greater than 150 psi (1,030 kPa).
  - (b) The employer shall assure that hose on all standpipe systems installed after July 1, 1982, is hydrostatically tested with couplings in place, at a pressure of not less than 200 psi (1,380 kPa), before it is placed in service. This pressure shall be maintained for at least fifteen seconds and not more than one minute during which time the hose shall not leak nor shall any jacket thread break during the test.
- (2) Maintenance.
- (a) The employer shall assure that water supply tanks are kept filled to the proper level except during repairs. When pressure tanks are used, the employer shall assure that proper pressure is maintained at all times except during repairs.
  - (b) The employer shall assure that valves in the main piping connections to the automatic sources of water supply are kept fully open at all times except during repair.
  - (c) The employer shall assure that hose systems are inspected at least annually and after each use to assure that all of the equipment and hose are in place, available for use, and in serviceable condition.
  - (d) When the system or any portion thereof is found not to be serviceable, the employer shall remove it from service immediately and replace it with equivalent protection such as extinguishers and fire watches.

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**WAC 296-24-60209 (Cont.)**

- (e) The employer shall assure that hemp or linen hose on existing systems is unracked, physically inspected for deterioration, and reracked using a different fold pattern at least annually. The employer shall assure that defective hose is replaced in accordance with WAC 296-24-60205 (3)(b).
- (f) The employer shall designate trained persons to conduct all inspections required under this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60209, filed 12/24/81.]

**WAC 296-24-60299 Appendix A-Standpipe and hose systems.**

- (1) Scope and application. This section has been written to provide adequate coverage of those standpipe and hose systems that an employer may install in the workplace to meet the requirements of a particular WISHA standard. For example, WISHA permits the substitution of hose systems for portable fire extinguishers in WAC 296-24-592. If an employer chooses to provide hose systems instead of portable Class A fire extinguishers, then those hose systems used for substitution would have to meet the applicable requirements of WAC 296-24-592. All other standpipe and hose systems not used as a substitute would be exempt from these requirements.

The section specifically exempts Class I large hose systems. By large hose systems, WISHA means those two and one-half inch hose lines that are usually associated with fire departments of the size that provide their own water supply through fire apparatus. When the fire gets to the size that outside protection of that degree is necessary, WISHA believes that in most industries employees will have been evacuated from the fire area and the "professional" fire fighters will take control.

- (2) Protection of standpipes. Employers must make sure that standpipes are protected so that they can be relied upon during a fire emergency. This means protecting the pipes from mechanical and physical damage. There are various means for protecting the equipment such as, but not limited to, enclosing the supply piping in the construction of the building, locating the standpipe in an area which is inaccessible to vehicles, or locating the standpipe in a stairwell.
- (3) Hose covers and cabinets. The employer should keep fire protection hose equipment in cabinets or inside protective covers which will protect it from the weather elements, dirt or other damaging sources. The use of protective covers must be easily removed or opened to assure that hose and nozzle are accessible. When the employer places hose in a cabinet, the employer must make sure that the hose and nozzle are accessible to employees without subjecting them to injury. In order to make sure that the equipment is readily accessible, the employer must also make sure that the cabinets used to store equipment are kept free of obstructions and other equipment which may interfere with the fast distribution of the fire hose stored in the cabinet.
- (4) Hose outlets and connections. The employer must assure that employees who use standpipe and hose systems can reach the hose rack and hose valve without the use of portable equipment such as ladders. Hose reels are encouraged for use because one employee can retrieve the hose, charge it, and place it into service without much difficulty.
- (5) Hose. When the employer elects to provide small hose in lieu of portable fire extinguishers, those hose stations being used for the substitution must have hose attached and ready for service. However, if more than the necessary amount of small hose outlets are provided, hose does not have to be attached to those outlets that would provide redundant coverage. Further, where the installation of hose on outlets may expose the hose to extremely cold climates, the employer may store the hose in houses or similar protective areas and connect it to the outlet when needed.

There is approved lined hose available that can be used to replace unlined hose which is stored on racks in cabinets. The lined hose is constructed so that it can be folded and placed in cabinets in the same manner as unlined hose.



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**WAC 296-24-60299 (Cont.)**

Hose is considered to be unserviceable when it deteriorates to the extent that it can no longer carry water at the required pressure and flow rates. Dry rotted linen or hemp hose, cross threaded couplings, and punctured hose are examples of unserviceable hose.

- (6) Nozzles. Variable stream nozzles can provide useful variations in water flow and spray patterns during fire fighting operations and they are recommended for employee use. It is recommended that 100 psi nozzle pressure be used to provide good flow patterns for variable stream nozzles. The most desirable attribute for nozzles is the ability of the nozzle person to shut off the water flow at the nozzle when it is necessary. This can be accomplished in many ways. For example, a shut-off nozzle with a lever or rotation of the nozzle to stop flow would be effective, but in other cases a simple globe valve placed between a straight stream nozzle and the hose could serve the same purpose. For straight stream nozzles, 50 psi nozzle pressure is recommended. The intent of the standard is to protect the employee from “run-away” hoses if it becomes necessary to drop a pressurized hose line and retreat from the fire front and other related hazards.
- (7) Design and installation. Standpipe and hose systems designed and installed in accordance with NFPA Standard No. 14-1976, “Standpipe and Hose Systems,” are considered to be in compliance with this standard.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60299, filed 12/24/81.]

**WAC 296-24-607 Automatic sprinkler systems.** The design and installation criteria for automatic sprinkler systems is contained in this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-607, filed 12/24/81.]

**WAC 296-24-60701 Scope and application.**

- (1) The requirements of this section apply to all automatic sprinkler systems installed to meet a particular WISHA standard.
- (2) For automatic sprinkler systems used to meet WISHA requirements and installed prior to the effective date of this standard, compliance with the National Fire Protection Association (NFPA) or the National Board of Fire Underwriters (NBFU) standard in effect at the time of the system's installation will be acceptable as compliance with this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60701, filed 12/24/81.]

**WAC 296-24-60703 Exemptions.** Automatic sprinkler systems installed in workplaces, but not required by WISHA are exempt from the requirements of this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60703, filed 12/24/81.]

**WAC 296-24-60705 General requirements.**

- (1) Design.
  - (a) All automatic sprinkler designs used to comply with this standard shall provide the necessary discharge patterns, densities, and water flow characteristics for complete coverage in a particular workplace or zoned subdivision of the workplace.
  - (b) The employer shall assure that only approved equipment and devices are used in the design and installation of automatic sprinkler systems used to comply with this standard.
- (2) Maintenance. The employer shall properly maintain an automatic sprinkler system installed to comply with this section. The employer shall assure that a main drain flow test is performed on each system annually. The inspector's test valve shall be opened at least every two years to assure that the sprinkler system operates properly.

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**WAC 296-24-60705 (Cont.)**

- (3) Acceptance tests. The employer shall conduct proper acceptance tests on sprinkler systems installed for employee protection after July 1, 1982, and record the dates of such tests. Proper acceptance tests include the following:
  - (a) Flushing of underground connections;
  - (b) Hydrostatic tests of piping in system;
  - (c) Air tests in dry-pipe systems;
  - (d) Dry-pipe valve operation; and
  - (e) Test of drainage facilities.
- (4) Water supplies. The employer shall assure that every automatic sprinkler system is provided with at least one automatic water supply capable of providing design water flow for at least thirty minutes. An auxiliary water supply or equivalent protection shall be provided when the automatic water supply is out of service, except for systems of twenty or fewer sprinklers.
- (5) Hose connections for fire fighting use. The employer may attach hose connections for fire fighting use to wet pipe sprinkler systems provided that the water supply satisfies the combined design demand for sprinklers and standpipes.
- (6) Protection of piping. The employer shall assure that automatic sprinkler system piping is protected against freezing and exterior surface corruptions.
- (7) Drainage. The employer shall assure that all dry sprinkler pipes and fittings are installed so that the systems may be totally drained.
- (8) Sprinklers.
  - (a) The employer shall assure that only approved sprinklers are used on systems.
  - (b) The employer may not use older style sprinklers to replace standard sprinklers without a complete engineering review of the altered part of the system.
  - (c) The employer shall assure that sprinklers are protected from mechanical damage.
- (9) Sprinkler alarms. On all sprinkler systems having more than twenty sprinklers, the employer shall assure that a local water-flow alarm is provided which sounds an audible signal on the premises upon water flow through the system equal to the flow from a single sprinkler.
- (10) Sprinkler spacing. The employer shall assure that sprinklers are spaced to provide a maximum protection area per sprinkler, a minimum of interference to the discharge pattern by building or structural members or building contents and suitable sensitivity to possible fire hazards. The minimum vertical clearance between sprinklers and material below shall be eighteen inches.
- (11) Hydraulically designed systems. The employer shall assure that hydraulically designed automatic sprinkler systems or portions thereof are identified and that the location, number of sprinklers in the hydraulically designed section, and the basis of the design is indicated. Central records may be used in lieu of signs at sprinkler valves provided the records are available for inspection and copying by the director.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60705, filed 12/24/81.]

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**WAC 296-24-60799 Appendix A-Automatic sprinkler systems.**

- (1) Scope and application. This section contains the minimum requirements for design, installation and maintenance of sprinkler systems that are needed for employee safety. The occupational safety and health administration is aware of the fact that the National Board of Fire Underwriters is no longer an active organization, however, sprinkler systems still exist that were designed and installed in accordance with that organization's standards. Therefore, WISHA will recognize sprinkler systems designed to, and maintained in accordance with, NBFU and earlier NFPA standards.
- (2) Exemptions. In an effort to assure that employers will continue to use automatic sprinkler systems as the primary fire protection system in workplaces, WISHA is exempting from coverage those systems not required by a particular WISHA standard and which have been installed in workplaces solely for the purpose of protecting property. Many of these types of systems are installed in areas or buildings with little or no employee exposure. An example is those warehouses where employees may enter occasionally to take inventory or move stock. Some employers may choose to shut down those systems which are not specifically required by WISHA rather than upgrade them to comply with the standards. WISHA does not intend to regulate such systems. WISHA only intends to regulate those systems which are installed to comply with a particular WISHA standard.
- (3) Design. There are two basic types of sprinkler system design. Pipe schedule designed systems are based on pipe schedule tables developed to protect hazards with standard sized pipe, number of sprinklers, and pipe lengths. Hydraulic designed systems are based on an engineered design of pipe size which will produce a given water density or flow rate at any particular point in the system. Either design can be used to comply with this standard.

The National Fire Protection Association's Standard No. 13, "Automatic Sprinkler Systems," contains the tables needed to design and install either type of system. Minimum water supplies, densities, and pipe sizes are given for all types of occupancies.

The employer may check with a reputable fire protection engineering consultant or sprinkler design company when evaluating existing systems or designing a new installation.

With the advent of new construction materials for the manufacture of sprinkler pipe, materials, other than steel, have been approved for use as sprinkler pipe. Selection of pipe material should be made on the basis of the type of installation and the acceptability of the material to local fire and building officials where such systems may serve more than one purpose.

Before new sprinkler systems are placed into service, an acceptance test is to be conducted. The employer should invite the installer, designer, insurance representative, and a local fire official to witness the test. Problems found during the test are to be corrected before the system is placed into service.

- (4) Maintenance. It is important that any sprinkler system maintenance be done only when there is minimal employee exposure to the fire hazard. For example, if repairs or changes to the system are to be made, they should be made during those hours when employees are not working or are not occupying that portion of the workplace protected by the portion of the system which has been shut down.

The procedures for performing a flow test via a main drain test or by the use of an inspector's test valve can be obtained from the employer's fire insurance company or from the National Fire Protection Association's Standard No. 13A, "Sprinkler System, Maintenance."

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**WAC 296-24-60799 (Cont.)**

- (5) Water supplies. The water supply to a sprinkler system is one of the most important factors an employer should consider when evaluating a system. Obviously, if there is no water supply, the system is useless. Water supplies can be lost for various reasons such as improperly closed valves, excessive demand, broken water mains, and broken fire pumps. The employer must be able to determine if or when this type of condition exists either by performing a main drain test or visual inspection. Another problem may be an inadequate water supply. For example, a light hazard occupancy may, through rehabilitation or change in tenants, become an ordinary or high hazard occupancy. In such cases, the exiting water supply may not be able to provide the pressure or duration necessary for proper protection. Employers must assure that proper design and tests have been made to assure an adequate water supply. These tests can be arranged through the employer's fire insurance carrier or through a local sprinkler maintenance company or through the local fire prevention organization.

Any time the employer must shut down the primary water supply for a sprinkler system, the standard requires that equivalent protection be provided. Equivalent protection may include a fire watch with extinguishers or hose lines in place and manned, or a secondary water supply such as a tank truck and pump, or a tank or fire pond with fire pumps, to protect the areas where the primary water supply is limited or shut down. The employer may also require evacuation of the workplace and have an emergency action plan which specifies such action.

- (6) Protection of piping. Piping which is exposed to corrosive atmospheres, either chemical or natural, can become defective to the extent that it is useless. Employers must assure that piping is protected from corrosion by its material of construction, e.g., stainless steel, or by a protective coating, e.g., paint.
- (7) Sprinklers. When an employer finds it necessary to replace sprinkler system components or otherwise change a sprinkler's design, employer should make a complete fire protection engineering survey of that part of the system being changed. This review should assure that the changes to the system will not alter the effectiveness of the system as it is presently designed. Water supplies, densities and flow characteristics should be maintained.
- (8) Protection of sprinklers. All components of the system must be protected from mechanical impact damage. This can be achieved with the use of mechanical guards or screens or by locating components in areas where physical contact is impossible or limited.
- (9) Sprinkler alarms. The most recognized sprinkler alarm is the water-motor gong or bell that sounds when water begins to flow through the system. This is not however, the only type of acceptable water flow alarm. Any alarm that gives an indication that water is flowing through the system is acceptable. For example, a siren, a whistle, a flashing light, or similar alerting device which can transmit a signal to the necessary persons would be acceptable. The purpose of the alarm is to alert persons that the system is operating, and that some type of planned action is necessary.
- (10) Sprinkler spacing. For a sprinkler system to be effective there must be an adequate discharge of water spray from the sprinkler head. Any obstructions which hinder the designed density or spray pattern of the water may create unprotected areas which can cause fire to spread. There are some sprinklers that, because of the system's design, are deflected to specific areas. This type of obstruction is acceptable if the system's design takes it into consideration in providing adequate coverage.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-60799, filed 12/24/81.]

**WAC 296-24-617 Fixed extinguishing systems, general.** This section applies to criteria required for fixed extinguisher systems and all sections of this chapter having number WAC 296-24-617 in the section number shall apply.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-617, filed 12/24/81.]

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**WAC 296-24-61701 Scope and application.**

- (1) This section applies to all fixed extinguishing systems installed to meet a particular WISHA standard except for automatic sprinkler systems which are covered by WAC 296-24-607.
- (2) This section also applies to fixed systems not installed to meet a particular WISHA standard, but which, by means of their operation, may expose employees to possible injury, death, or adverse health consequences caused by the extinguishing agent. Such systems are only subject to the requirements of WAC 296-24-61703 (4) through (7) and 296-24-61705.
- (3) Systems otherwise covered in subsection (2) of this section which are installed in areas with no employee exposure are exempted from the requirements of this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-61701, filed 12/24/81.]

**WAC 296-24-61703 General requirements.**

- (1) Fixed extinguishing system components and agents shall be designed and approved for use on the specific fire hazards they are expected to control or extinguish.
- (2) If for any reason a fixed extinguishing system becomes inoperable, the employer shall notify employees and take the necessary temporary precautions to assure their safety until the system is restored to operating order. Any defects or impairments shall be properly corrected by trained personnel.
- (3) The employer shall provide a distinctive alarm or signaling system which complies with WAC 296-24-631, and is capable of being perceived above ambient noise or light levels, on all extinguishing systems in those portions of the workplace covered by the extinguishing system to indicate when the extinguishing system is discharging. Discharge alarms are not required on systems where discharge is immediately recognizable.
- (4) The employer shall provide effective safeguards to warn employees against entry into discharge areas where the atmosphere remains hazardous to employee safety or health.
- (5) The employer shall post hazard warning or caution signs at the entrance to, and inside of, areas protected by fixed extinguishing systems which use agents in concentrations known to be hazardous to employee safety and health.
- (6) The employer shall assure that fixed systems are inspected annually by a person knowledgeable in the design and function of the system to assure that the system is maintained in good operating condition.
- (7) The employer shall assure that the weight and pressure of refillable containers is checked at least semiannually. If the container shows a loss in net content or weight of more than five percent, or a loss in pressure of more than ten percent, it shall be subjected to maintenance.
- (8) The employer shall assure that factory charged nonrefillable containers which have no means of pressure indication are weighed at least semiannually. If a container shows a loss in net weight of more than five percent it shall be replaced.
- (9) The employer shall assure that inspection and maintenance dates are recorded on the container, on a tag attached to the container, or in a central location. A record of the last semiannual check shall be maintained until the container is checked again or for the life of the container, whichever is less.
- (10) The employer shall train employees designated to inspect, maintain, operate, or repair fixed extinguishing systems and annually review their training to keep them up-to-date in the functions they are to perform.

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**WAC 296-24-61703 (Cont.)**

- (11) The employer shall not use chlorobromomethane or carbon tetrachloride as an extinguishing agent where employees may be exposed.
- (12) The employer shall assure that systems installed in the presence of corrosive atmospheres are constructed of noncorrosive material or otherwise protected against corrosion.
- (13) Automatic detection equipment shall be approved, installed and maintained in accordance with WAC 296-24-629.
- (14) The employer shall assure that all systems designed for and installed in areas with climatic extremes shall operate effectively at the expected extreme temperatures.
- (15) The employer shall assure that at least one manual station is provided for discharge activation of each fixed extinguishing system.
- (16) The employer shall assure that manual operating devices are identified as to the hazard against which they will provide protection.
- (17) The employer shall provide and assure the use of the personal protective equipment needed for immediate rescue of employees trapped in hazardous atmospheres created by an agent discharge.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-61703, filed 12/24/81.]

**WAC 296-24-61705 Total flooding systems with potential health and safety hazards to employees.**

- (1) The employer shall provide an emergency action plan in accordance with WAC 296-24-567 for each area within a workplace that is protected by a total flooding system which provides agent concentrations exceeding the maximum safe levels.
- (2) Systems installed in areas where employees cannot enter during or after the system's operation are exempt from the requirements of this section.
- (3) On all total flooding systems the employer must provide a predischARGE employee alarm which will give employees time to safely exit from the discharge area prior to system discharge.

Your predischARGE employee alarm systems must:

- Provide enough warning to allow employees to safely escape from the workplace or the immediate work area or both;
- Be capable of being perceived above ambient noise or light levels by all employees in the affected portions of the workplace before system discharge;
- Be distinctive and recognizable as a signal to evacuate the work area;
- Be kept in operating condition except when undergoing repairs or maintenance.

You must explain to each employee how to report emergencies in your workplace. Methods of reporting emergencies include manual pull box alarms, public address systems, radio, or telephones. Post emergency telephone numbers near telephones, or employee notice boards, or other conspicuous locations if you use telephones to report emergencies.

If you use a communication system that also serves as an employee alarm system, all emergency messages must have priority over all nonemergency messages.

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**WAC 296-24-61705 (Cont.)**

- (4) The employer shall provide automatic actuation of total flooding systems by means of an approved fire detection device installed and interconnected with a predischARGE employee alarm system to give employees time to safely exit from the discharge area prior to system discharge.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-61705, filed 05/09/01, effective 09/01/01. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-61705, filed 12/24/81.]

**WAC 296-24-61799 Appendix A-Fixed extinguishing systems, general.**

- (1) Scope and application. This section contains the general requirements that are applicable to all fixed extinguishing systems installed to meet WISHA standards. It also applies to those fixed extinguishing systems, generally total flooding, which are not required by WISHA, but which, because of the agent's discharge, may expose employees to hazardous concentrations of extinguishing agents or combustion byproducts. Employees who work around fixed extinguishing systems must be warned of the possible hazards associated with the system and its agent. For example, fixed dry chemical extinguishing systems may generate a large enough cloud of dry chemical particles that employees may become visually disoriented. Certain gaseous agents can expose employees to hazardous byproducts of combustion when the agent comes into contact with hot metal or other hot surface. Some gaseous agents may be present in hazardous concentrations when the system has totally discharged because an extra rich concentration is necessary to extinguish deep-seated fires. Certain local application systems may be designed to discharge onto the flaming surface of a liquid, and it is possible that the liquid can splatter when hit with the discharging agent. All of these hazards must be determined before the system is placed into operation, and must be discussed with employees.

Based on the known toxicological effects of agents such as carbon tetrachloride and chlorobromomethane, WISHA is not permitting the use of these agents in areas where employees can be exposed to the agent or its side effects. However, chlorobromomethane has been accepted and may be used as an explosion suppression agent in unoccupied spaces. WISHA is permitting the use of this agent only in areas where employees will not be exposed.

- (2) Distinctive alarm signals. A distinctive alarm signal is required to indicate that a fixed system is discharging. Such a signal is necessary on those systems where it is not immediately apparent that the system is discharging. For example, certain gaseous agents make a loud noise when they discharge. In this case, no alarm signal is necessary. However, where systems are located in remote locations or away from the general work area and where it is possible that a system could discharge without anyone knowing that it is doing so, then a distinctive alarm is necessary to warn employees of the hazards that may exist. The alarm can be a bell, gong, whistle, horn, flashing light, or any combination of signals as long as it is identifiable as a discharge alarm.
- (3) Maintenance. The employer is responsible for the maintenance of all fixed systems, but this responsibility does not preclude the use of outside contractors to do such work. New systems should be subjected to an acceptance test before placed in service. The employer should invite the installer, designer, insurance representative and others to witness the test. Problems found during the test need to be corrected before the system is considered operational.
- (4) Manual discharge stations. There are instances, such as for mechanical reasons and others, where the standards call for a manual backup activation device. While the location of this device is not specified in the standard, the employer should assume that the device should be located where employees can easily reach it. It could, for example, be located along the main means of egress from the protected area so that employees could activate the system as they evacuate the work area.

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**WAC 296-24-61799 (Cont.)**

- (5) Personal protective equipment. The employer is required to provide the necessary personal protective equipment to rescue employees who may be trapped in a totally flooded environment which may be hazardous to their health. The equipment would normally include a positive-pressure self-contained breathing apparatus and any necessary first aid equipment. In cases where the employer can assure the prompt arrival of the local fire department or plant emergency personnel which can provide the equipment, this can be considered as complying with the standards.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-61799, filed 12/24/81.]

**WAC 296-24-622 Fixed extinguishing systems, dry chemical.** The design and installation requirements specifically applicable to fixed extinguishing systems, using dry chemical as the extinguishing agent, are contained in this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-622, filed 12/24/81.]

**WAC 296-24-62201 Scope and application.** This section applies to all fixed extinguishing systems using dry chemical as the extinguishing agent, installed to meet a particular WISHA standard. These systems shall also comply with WAC 296-24-617.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62201, filed 12/24/81.]

**WAC 296-24-62203 Specific requirements.**

- (1) The employer shall assure that dry chemical agents are compatible with any foams or wetting agents with which they are used.
- (2) The employer may not mix together dry chemical extinguishing agents of different compositions. The employer shall assure that dry chemical systems are refilled with the chemical stated on the approval nameplate or an equivalent compatible material.
- (3) When dry chemical discharge may obscure vision, the employer must provide a predischage employee alarm which will give employees time to safely exit from the discharge area prior to system discharge.

Your predischage employee alarm systems must:

- Provide enough warning to allow employees to safely escape from the workplace or the immediate work area or both;
- Be capable of being perceived above ambient noise or light levels by all employees in the affected portions of the workplace before system discharge;
- Be distinctive and recognizable as a signal to evacuate the work area;
- Be kept in operating condition except when undergoing repairs or maintenance.

You must explain to each employee how to report emergencies in your workplace. Methods of reporting emergencies include manual pull box alarms, public address systems, radio, or telephones. Post emergency telephone numbers near telephones, or employee notice boards, or other conspicuous locations if you use telephones to report emergencies.

If you use a communication system that also serves as an employee alarm system, all emergency messages must have priority over all nonemergency messages.

- (4) The employer shall sample the dry chemical supply of all but stored pressure systems at least annually to assure that the dry chemical supply is free of moisture which may cause the supply to cake or form lumps.
- (5) The employer shall assure that the rate of application of dry chemicals is such that the designed concentration of the system will be reached within thirty seconds of initial discharge.

[Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-24-62203, filed 05/09/01, effective 09/01/01.]

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62203, filed 12/24/81.]



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**WAC 296-24-62299 Appendix A-Fixed extinguishing systems, dry chemical.**

- (1) Scope and application. The requirements of this section apply only to dry chemical systems. These requirements are to be used in conjunction with the requirements of WAC 296-24-617.
- (2) Maintenance. The employer is responsible for assuring that dry chemical systems will operate effectively. To do this, periodic maintenance is necessary. One test that must be conducted during the maintenance check is one which will determine if the agent has remained free of moisture. If an agent absorbs any moisture, it may tend to cake and thereby clog the system. An easy test for acceptable moisture content is to take a lump of dry chemical from the container and drop it from a height of four inches. If the lump crumbles into fine particles, the agent is acceptable.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62299, filed 12/24/81.]

**WAC 296-24-623 Fixed extinguishing systems, gaseous agent.** This section contains the design and installation requirements for fixed extinguishing systems using gaseous agents.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-623, filed 12/24/81.]

**WAC 296-24-62301 Scope and application.**

- (1) Scope. This section applies to all fixed extinguishing systems, using a gas as the extinguishing agent, installed to meet a particular WISHA standard. These systems shall also comply with WAC 296-24-617. In some cases, the gas may be in a liquid state during storage.
- (2) Application. The requirements of WAC 296-24-61703 (2) and (4) through (7) shall apply only to total flooding systems.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62301, filed 12/24/81.]

**WAC 296-24-62303 Specific requirements.**

- (1) Agents used for initial supply and replenishment shall be of the type approved for the system's application. Carbon dioxide obtained by dry ice conversion to liquid is not acceptable unless it is processed to remove excess water and oil.
- (2) Except during overhaul, the employer shall assure that the designed concentration of gaseous agents is maintained until the fire has been extinguished or is under control.
- (3) The employer shall assure that employees are not exposed to toxic levels of gaseous agent or its decomposition products.
- (4) The employer shall assure that the designed extinguishing concentration is reached within thirty seconds of initial discharge except for Halon systems which must achieve design concentration within ten seconds.
- (5) The employer shall provide a distinctive predischage employee alarm capable of being perceived above ambient light or noise levels when agent design concentrations exceed the maximum safe level for employee exposure. A predischage employee alarm for alerting employees before system discharge shall be provided on Halon 1211 and carbon dioxide systems with a design concentration of four percent or greater, and for Halon 1301 systems with a design concentration of ten percent or greater. The predischage employee alarm shall provide employees time to safely exit the discharge area prior to system discharge.
- (6)(a) Where egress from an area cannot be accomplished within one minute, the employer shall not use Halon 1301 in concentrations greater than seven percent.

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**WAC 296-24-62303 (Cont.)**

- (b) Where egress takes greater than thirty seconds but less than one minute, the employer shall not use Halon 1301 in a concentration greater than ten percent.
- (c) Halon 1301 concentrations greater than ten percent are only permitted in areas not normally occupied by employees provided that any employee in the area can escape within thirty seconds. The employer shall assure that no unprotected employees enter the area during agent discharge.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62303, filed 12/24/81.]

**WAC 296-24-62399 Appendix A-Fixed extinguishing systems, gaseous agent.**

- (1) Scope and application. This section applies only to those systems which use gaseous agents. The requirements of WAC 296-24-617 also apply to the gaseous agent systems covered in this section.
- (2) Design concentrations. Total flooding gaseous systems are based on the volume of gas which must be discharged in order to produce a certain designed concentration of gas in an enclosed area. The concentration needed to extinguish a fire depends on several factors including the type of fire hazard and the amount of gas expected to leak away from the area during discharge. At times it is necessary to “super-saturate” a work area to provide for expected leakage from the enclosed area. In such cases, employers must assure that the flooded area has been ventilated before employees are permitted to reenter the work area without protective clothing and respirators.
- (3) Toxic decomposition. Certain halogenated hydrocarbons will break down or decompose when they are combined with high temperatures found in the fire environment. The products of the decomposition can include toxic elements or compounds. For example, when Halon 1211 is placed into contact with hot metal it will break down and form bromide or fluoride fumes. The employer must find out which toxic products may result from decomposition of a particular agent from the manufacturer, and take the necessary precautions to prevent employee exposure to the hazard.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62399, filed 12/24/81.]

**WAC 296-24-627 Fixed extinguishing systems, water spray and foam.** This section contains the design and installation requirements for extinguishing systems using water or foam solution as the extinguishing agent.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-627, filed 12/24/81.]

**WAC 296-24-62701 Scope and application.** This section applies to all fixed extinguishing systems, using water or foam solution as the extinguishing agent, installed to meet a particular WISHA standard. These systems shall also comply with WAC 296-24-617. This section does not apply to automatic sprinkler systems which are covered under WAC 296-24-607.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62701, filed 12/24/81.]

**WAC 296-24-62703 Specific requirements.**

- (1) The employer shall assure that foam and water spray systems are designed to be effective in at least controlling fire in the protected area or on protected equipment.
- (2) The employer shall assure that drainage of water spray systems is directed away from areas where employees are working and that no emergency egress is permitted through the drainage path.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62703, filed 12/24/81.]

**WAC 296-24-62799 Appendix A-Fixed extinguishing systems, water spray and foam.**

- (1) Scope and application. This section applies to those systems that use water spray or foam. The requirements of WAC 296-24-617 also apply to this type of system.

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**WAC 296-24-62799 (Cont.)**

- (2) Characteristics of foams. When selecting the type of foam for a specific hazard, the employer should consider the following limitations of some foams.
- (a) Some foams are not acceptable for use on fires involving flammable gases and liquefied gases with boiling points below ambient workplace temperatures. Other foams are not effective when used on fires involving polar solvent liquids.
  - (b) Any agent using water as part of the mixture should not be used on fire involving combustible metals unless it is applied under proper conditions to reduce the temperature of burning metal below the ignition temperature. The employer should use only those foams that have been tested and accepted for this application by a recognized independent testing laboratory.
  - (c) Certain types of foams may be incompatible and break down when they are mixed together.
  - (d) For fires involving water miscible solvents, employers should use only those foams tested and approved for such use. Regular protein foams may not be effective on such solvents.

Whenever employers provide a foam or water spray system, drainage facilities must be provided to carry contaminated water or foam overflow away from the employee work area and egress routes. This drainage system should drain to a central impounding area where it can be collected and disposed of properly. Other government agencies may have regulations concerning environmental considerations.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62799, filed 12/24/81.]

**WAC 296-24-629 Fire detection systems.** The requirements for installation, restoration, maintenance, testing and protection of fire detection systems and the criteria for response time can be found in this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-629, filed 12/24/81.]

**WAC 296-24-62901 Scope and application.** This section applies to all automatic fire detection systems installed to meet the requirements of a particular WISHA standard.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62901, filed 12/24/81.]

**WAC 296-24-62903 Installation and restoration.**

- (1) The employer shall assure that all devices and equipment constructed and installed to comply with this standard are approved for the purpose for which they are intended.
- (2) The employer shall restore all fire detection systems and components to normal operating condition as promptly as possible after each test or alarm. Spare detection devices and components which are normally destroyed in the process of detecting fires shall be available on the premises or from a local supplier in sufficient quantities and locations for prompt restoration of the system.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62903, filed 12/24/81.]

**WAC 296-24-62905 Maintenance and testing.**

- (1) The employer shall maintain all systems in an operable condition except during repairs or maintenance.
- (2) The employer shall assure that fire detectors and fire detection systems are tested and adjusted as often as needed to maintain proper reliability and operating condition except that factory calibrated detectors need not be adjusted after installation.
- (3) The employer shall assure that pneumatic and hydraulic operated detection systems installed after July 1, 1982, are equipped with supervised systems.

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**WAC 296-24-62905 (Cont.)**

- (4) The employer shall assure that the servicing, maintenance and testing of fire detection systems, including cleaning and necessary sensitivity adjustments are performed by a trained person knowledgeable in the operations and functions of the system.
- (5) The employer shall also assure that fire detectors that need to be cleaned of dirt, dust, or other particulates in order to be fully operational are cleaned at regular periodic intervals.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62905, filed 12/24/81.]

**WAC 296-24-62907 Protection of fire detectors.**

- (1) The employer shall assure that fire detection equipment installed outdoors or in the presence of corrosive atmospheres be protected from corrosion. The employer shall provide a canopy, hood, or other suitable protection for detection equipment requiring protection from the weather.
- (2) The employer shall locate or otherwise protect detection equipment so that it is protected from mechanical or physical impact which might render it inoperable.
- (3) The employer shall assure that detectors are supported independently of their attachment to wires or tubing.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62907, filed 12/24/81.]

**WAC 296-24-62909 Response time.**

- (1) The employer shall assure that fire detection systems installed for the purpose of actuating fire extinguishment or suppression systems shall be designed to operate in time to control or extinguish a fire.
- (2) The employer shall assure that fire detection systems installed for the purpose of employee alarm and evacuation be designed and installed to provide a warning for emergency action and safe escape of employees.
- (3) The employer shall not delay alarms or devices initiated by fire detector actuation for more than thirty seconds unless such delay is necessary for the immediate safety of employees. When such delay is necessary, it shall be addressed in an emergency action plan meeting the requirements of WAC 296-24-567.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62909, filed 12/24/81.]

**WAC 296-24-62911 Number, location and spacing of detecting devices.** The employer shall assure that the number, spacing and location of fire detectors is based upon design data obtained from field experience, or tests, engineering surveys, the manufacturer's recommendations, or a recognized testing laboratory listing.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62911, filed 12/24/81.]

**WAC 296-24-62999 Appendix A-Fire detection systems.**

- (1) Installation and restoration. Fire detection systems must be designed by knowledgeable engineers or other professionals, with expertise in fire detection systems and when the systems are installed, there should be an acceptance test performed on the system to insure it operates properly. The manufacturer's recommendations for system design should be consulted. While entire systems may not be approved, each component used in the system is required to be approved. Custom fire detection systems should be designed by knowledgeable fire protection or electrical engineers who are familiar with the workplace hazards and conditions. Some systems may only have one or two individual detectors for a small workplace, but good design and installation is still important. An acceptance test should be performed on all systems, including these smaller systems.

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**WAC 296-24-62999 (Cont.)**

WISHA has a requirement that spare components used to replace those which may be destroyed during an alarm situation be available in sufficient quantities and locations for prompt restoration of the system. This does not mean that the parts or components have to be stored at the workplace. If the employer can assure that the supply of parts is available in the local community or the general metropolitan area of the workplace, then the requirements for storage and availability have been met. The intent is to make sure that the alarm system is fully operational when employees are occupying the workplace, and that when the system operates it can be returned to full service the next day or sooner.

- (2) Supervision. Fire detection systems should be supervised. The object of supervision is detection of any failure of the circuitry, and the employer should use any method that will assure that the system's circuits are operational. Electrically operated sensors for air pressure, fluid pressure, or electrical circuits, can provide effective monitoring and are the typical types of supervision.
- (3) Protection of fire detectors. Fire detectors must be protected from corrosion either by protective coating, by being manufactured from noncorrosive materials or by location. Detectors must also be protected from mechanical impact damage, either by suitable cages or metal guards where such hazards are present, or by locating them above or out of contact with materials or equipment which may cause damage.
- (4) Number, location, and spacing of detectors. This information can be obtained from the approval listing for detectors or NFPA standards. It can also be obtained from fire protection engineers or consultants or manufacturers of equipment who have access to approval listing and design methods.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-62999, filed 12/24/81.]

**WAC 296-24-63299 Appendix B-National consensus standards.** The following table contains a cross-reference listing of those current national consensus standards which contains information and guidelines that would be considered acceptable in complying with requirements in the specific sections.

Section	National Consensus Standard
WAC 296-24-58505	ANSI/NFPA No. 1972, Structural Fire Fighter's Helmets. ANSI Z88.5 American National Standard, Practice for Respirator Protection for the Fire Service. ANSI/NFPA No. 1971, Protective Clothing for Structural Fire Fighters. NFPA No. 1041, Fire Service Instructor Professional Qualifications.
WAC 296-24-592	ANSI/NFPA No. 10, Portable Fire Extinguishers.
WAC 296-24-602	ANSI/NFPA No. 18, Wetting Agents. ANSI/NFPA No. 20, Centrifugal Fire Pumps. NFPA No. 21, Steam Fire Pumps. ANSI/NFPA No. 22, Water Tanks. NFPA No. 24, Outside Protection. NFPA No. 26, Supervision of Valves. NFPA No. 13E, Fire Department Operations in Properties Protected by Sprinkler, Standpipe Systems. ANSI/NFPA No. 194, Fire Hose Connections. NFPA No. 197, Initial Fire Attack, Training for. NFPA No. 1231, Water Supplies for Suburban and Rural Fire Fighting.

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<b>Section</b>	<b>National Consensus Standard</b>
WAC 296-24-607	ANSI/NFPA No. 13, Sprinkler Systems. NFPA No. 13A, Sprinkler Systems, Maintenance. ANSI/NFPA No. 18, Wetting Agents. ANSI/NFPA No. 20, Centrifugal Fire Pumps. ANSI/NFPA No. 22, Water Tanks. NFPA No. 24, Outside Protection. NFPA No. 26, Supervision of Valves. ANSI/NFPA No. 72B, Auxiliary Signaling Systems. NFPA No. 1231, Water Supplies for Suburban and Rural Fire Fighting.
WAC 296-24-617	ANSI/NFPA No. 11, Foam Systems. ANSI/NFPA No. 11A, High Expansion Foam Extinguishing Systems. ANSI/NFPA No. 11B, Synthetic Foam and Combined Agent Systems. ANSI/NFPA No. 12, Carbon Dioxide Systems. ANSI/NFPA No. 12A, Halon 1301 Systems. ANSI/NFPA No. 12B, Halon 1211 Systems. ANSI/NFPA No. 15, Water Spray Systems. ANSI/NFPA No. 16, Foam-Water Spray Systems. ANSI/NFPA No. 17, Dry Chemical Systems. ANSI/NFPA No. 69, Explosion Suppression Systems.
WAC 296-24-622	ANSI/NFPA No. 11B, Synthetic Foam and Combined Agent Systems. ANSI/NFPA No. 17, Dry Chemical Systems.
WAC 296-24-623	ANSI/NFPA No. 12, Carbon Dioxide Systems. ANSI/NFPA No. 12A, Halon 1211 Systems. ANSI/NFPA No. 12B, Halon 1301 Systems. ANSI/NFPA No. 69, Explosion Suppression Systems.
WAC 296-24-627	ANSI/NFPA No. 11, Foam Extinguishing Systems. ANSI/NFPA No. 11A, High Expansion Foam Extinguishing Systems. ANSI/NFPA No. 11B, Synthetic Foam and Combined Agent Systems. ANSI/NFPA No. 15, Water Spray Fixed Systems. ANSI/NFPA No. 16, Foam-Water Spray Systems. ANSI/NFPA No. 18, Wetting Agents. NFPA No. 26, Supervision of Valves.
WAC 296-24-629	ANSI/NFPA No. 71, Central Station Signaling Systems. ANSI/NFPA No. 72A, Local Protective Signaling Systems. ANSI/NFPA No. 72B, Auxiliary Signaling Systems. ANSI/NFPA No. 72D, Proprietary Protective Signaling Systems. ANSI/NFPA No. 72E, Automatic Fire Detectors. ANSI/NFPA No. 101, Life Safety Code.
WAC 296-24-631	ANSI/NFPA No. 71, Central Station Signaling Systems. ANSI/NFPA No. 72A, Local Protective Signaling Systems. ANSI/NFPA No. 72B, Auxiliary Protective Signaling Systems. ANSI/NFPA No. 72C, Remote Station Protective Signaling Systems. ANSI/NFPA No. 72D, Proprietary Protective Signaling Systems. ANSI/NFPA No. 101, Life Safety Code.
Metric Conversion	ANSI/ASTM NSo. E380, American National Standard for Metric Practice.

NFPA standards are available from the National Fire Protection Association; Batterymarch Park, Quincy, MA 02269-9101.

ANSI Standards are available from the American National Standards Institute; 11 West 42nd Street; New York, NY 10036.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-63299, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-63299, filed 12/24/81.]

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**WAC 296-24-63399 Appendix C-Fire protection references for further information.**

- (1) Appendix general references. The following references provide information which can be helpful in understanding the requirements contained in all of the sections of Part G:
  - (a) Fire Protection Handbook, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (b) Accident Prevention Manual for Industrial Operations, National Safety Council, 444 North Michigan Avenue, Chicago, IL 60611.
  - (c) Various associations also publish information which may be useful in understanding these standards. Examples of these associations are: Fire Equipment Manufacturers Association (FEMA) of Cleveland, OH 44115-2851, and the National Association of Fire Equipment Distributors (NAFED) of Chicago, IL 60611-4267.
- (2) Appendix references applicable to individual sections. The following references are grouped according to individual sections contained in Part G. These references provide information which may be helpful in understanding and implementing the standards of each section of Part G.
  - (a) WAC 296-24-58505 - Fire brigades:
    - (i) Private Fire Brigades, NFPA 27; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
    - (ii) Initial Fire Attack, Training Standard On, NFPA 197; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
    - (iii) Fire Fighter Professional Qualifications, NFPA 1001; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
    - (iv) Organization for Fire Services, NFPA 1201; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
    - (v) Organization of a Fire Department, NFPA 1202; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
    - (vi) Protective Clothing for Structural Fire Fighting, ANSI/NFPA 1971; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
    - (vii) American National Standards Institute for Men's Safety-Toe Footwear, ANSI Z41.1; American National Standards Institute, New York, NY 10036.
    - (viii) American National Standards Institute for Occupational and Educational Eye and Face Protection, ANSI Z87.1; American National Standards Institute, New York, NY 10036.
    - (ix) American National Standards Institute, Safety Requirements for Industrial Head Protection, ANSI Z89.1; American National Standards Institute, New York, NY 10036.
    - (x) Specifications for Protective Headgear for Vehicular Users, ANSI Z90.1; American National Standards Institute, New York, NY 10036.
    - (xi) Testing Physical Fitness; Davis and Santa Maria, Fire Command, April 1975.

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- (xii) Development of a Job-Related Physical Performance Examination for Fire Fighters; Dotson and Others. A summary report for the National Fire Prevention and Control Administration, Washington, D.C., March 1977.
  - (xiii) Proposed Sample Standards for Fire Fighters' Protective Clothing and Equipment; International Association of Fire Fighters, Washington, D.C. 20006-5395.
  - (xiv) A Study of Facepiece Leakage of Self-Contained Breathing Apparatus by DOP Man Tests; Los Alamos National Laboratory, Los Alamos, N.M.
  - (xv) The Development of Criteria for Fire Fighters' Gloves; Vol. II: Glove Criteria and Test Methods; National Institute for Occupational Safety and Health, Cincinnati, Ohio, 1976.
  - (xvi) Model Performance Criteria for Structural Fire Fighters' Helmets; National Fire Prevention and Control Administration, Washington, D.C., 1977.
  - (xvii) Fire Fighters; Job Safety and Health Magazine, Occupational Safety and Health Administration, Washington, D.C., June 1978.
  - (xviii) Eating Smoke-The Dispensable Diet; Utech, H.P. The Fire Independent, 1975.
  - (xix) Project Monoxide-A Medical Study of an Occupational Hazard of Fire Fighters; International Association of Fire Fighters, Washington, D.C. 20006-5395.
  - (xx) Occupational Exposures to Carbon Monoxide in Baltimore Fire Fighters; Radford Baltimore, MD. Journal of Occupational Medicine, September, 1976.
  - (xxi) Fire Brigades; National Safety Council, Chicago, IL 60611, 1966.
  - (xxii) American National Standards Institute, Practice for Respiratory Protection for the Fire Service, ANSI Z88.5; American National Standards Institute, New York, NY 10036.
  - (xxiii) Respirator Studies for the Nuclear Regulatory Commission; October 1, 1977-September 30, 1978. Evaluation and Performance of Open-Circuit Breathing Apparatus. NUREG/CR-1235. Los Alamos National Laboratory; Los Alamos, NM 87545, January, 1980.
- (b) WAC 296-24-592 - Portable fire extinguishers:
- (i) Standard for Portable Fire Extinguishers, ANSI/NFPA 10; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
  - (ii) Methods for Hydrostatic Testing of Compressed-Gas Cylinders, C-1; Compressed Gas Association, 1725 Jefferson Davis Highway, Arlington, VA 22202-4100.
  - (iii) Recommendations for the Disposition of Unserviceable Compressed-Gas Cylinders, C-2; Compressed Gas Association, 1725 Jefferson Davis Highway, Arlington, VA 22202-4100.
  - (iv) Standard for Visual Inspection of Compressed-Gas Cylinders, C-6; Compressed Gas Association, 1725 Jefferson Davis Highway, Arlington, VA 22202-4100.



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- (v) Portable Fire Extinguisher Selection Guide, National Association of Fire Equipment Distributors, 401 North Michigan Avenue Chicago, IL 60611-4267.
- (c) WAC 296-24-602 - Standpipe and hose systems:
  - (i) Standard for the Installation of Sprinkler Systems, ANSI/NFPA 13; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) Standard of the Installation of Standpipe and Hose Systems, ANSI/NFPA 14; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard for the Installation of Centrifugal Fire Pumps, ANSI/NFPA 20; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iv) Standard for Water Tanks for Private Fire Protection, ANSI/NFPA 22; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (v) Standard for Screw Threads and Gaskets for Fire Hose Connections, ANSI/NFPA 194; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (vi) Standard for Fire Hose, NFPA 196; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (vii) Standard for the Care of Fire Hose, NFPA 198; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (d) WAC 296-24-607 - Automatic sprinkler systems:
  - (i) Standard of the Installation of Sprinkler Systems, ANSI/NFPA 13; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) Standard for the Care and Maintenance of Sprinkler Systems, ANSI/NFPA 13A; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard for the Installation of Standpipe and Hose Systems, ANSI/NFPA 14; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iv) Standard for the Installation of Centrifugal Fire Pumps, ANSI/NFPA 20; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (v) Standard for Water Tanks for Private Fire Protection, ANSI/NFPA 22; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (vi) Standard for Indoor General Storage, ANSI/NFPA 231; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (vii) Standard for Rack Storage of Materials, ANSI/NFPA 231C; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.

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- (e) WAC 296-24-617 0 - Fixed extinguishing systems, general information:
  - (i) Standard for Foam Extinguishing Systems, ANSI/NFPA 11; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) Standard for Hi-Expansion Foam Systems, ANSI/NFPA 11A; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard on Synthetic Foam and Combined Agent Systems, ANSI/NFPA 11B; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iv) Standard on Carbon Dioxide Extinguishing Systems, ANSI/NFPA 12; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (v) Standard on Halon 1301, ANSI/NFPA 12A; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (vi) Standard on Halon 1211, ANSI/NFPA 12B; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (vii) Standard for Water Spray Systems, ANSI/NFPA 15; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (viii) Standard for Foam-Water Sprinkler Systems and Foam-Water Spray Systems, ANSI/NFPA 16; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ix) Standard for Dry Chemical Extinguishing Systems, ANSI/NFPA 17; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (f) WAC 296-24-622 - Fixed extinguishing systems, dry chemical:
  - (i) Standard for Dry Chemical Extinguishing Systems, ANSI/NFPA 17; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) National Electrical Code, ANSI/NFPA 70; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapor from Commercial Cooling Equipment, NFPA 96; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (g) WAC 296-24-623 - Fixed extinguishing systems, gaseous agents:
  - (i) Standard on Carbon Dioxide Extinguishing Systems, ANSI/NFPA 12; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) Standard on Halon 1301, ANSI/NFPA 12B; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard on Halon 1211, ANSI/NFPA 12B; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.

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- (iv) Standard on Explosion Prevention Systems, ANSI/NFPA 69; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (v) National Electrical Code, ANSI/NFPA 70; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (vi) Standard on Automatic Fire Detectors, ANSI/NFPA 72E; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (vii) Determination of Halon 1301/1211 Threshold Extinguishing Concentrations Using the Cup Burner Method, Riley and Olson, Ansul Report AL-530-A.
- (h) WAC 296-24-627 - Fixed extinguishing systems, water spray and foam agents:
  - (i) Standard for Foam Extinguisher Systems, ANSI/NFPA 11; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) Standard for High-Expansion Foam Systems, ANSI/NFPA 11A; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard for Water Spray Fixed Systems for Fire Protection, ANSI/NFPA 15; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iv) Standard for the Installation of Foam-Water Sprinkler Systems and Foam-Water Spray Systems, ANSI/NFPA 16; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (i) WAC 296-24-629 - Fire detection systems:
  - (i) National Electrical Code, ANSI/NFPA 70; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) Standard for Central Station Signaling Systems, ANSI/NFPA 71; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard on Automatic Fire Detectors, ANSI/NFPA 72E; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (j) WAC 296-24-631 - Employee alarm systems:
  - (i) National Electrical Code, ANSI/NFPA 70; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (ii) Standard for Central Station Signaling Systems, ANSI/NFPA 71; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iii) Standard for Local Protective Signaling Systems, ANSI/NFPA 72A; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
  - (iv) Standard for Auxiliary Protective Signaling Systems, ANSI/NFPA 72B; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.

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- (v) Standard for Remote Station Protective Signaling Systems, ANSI/NFPA 72C; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (vi) Standard for Proprietary Protective Signaling Systems, ANSI/NFPA 72D; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
- (vii) Vocal Emergency Alarms in Hospitals and Nursing Facilities: Practice and Potential, National Institute of Standards and Technology, Quince Orchard and Clopper Roads, Gaithersburg, MD 20899-0011, July, 1977.
- (viii) Fire Alarm and Communication Systems, National Institute of Standards and Technology, Quince Orchard and Clopper Roads, Gaithersburg, MD 20899-0011, April, 1976.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-63399, filed 7/20/94, effective 9/20/94; 92-23-017 (Order 92-13), § 296-24-63399, filed 11/10/92, effective 12/18/92; 88-14-108 (Order 88-11), § 296-24-63399, filed 7/6/88; 87-24-051 (Order 87-24), § 296-24-63399, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-63399, filed 12/24/81.]

**WAC 296-24-63499 Appendix D-Availability of publications incorporated by references in WAC 296-24-58505-Fire brigades.** The final standard for fire brigades, WAC 296-24-585, contains provisions which incorporate certain publications by reference. The publications provide criteria and test methods for protective clothing worn by those fire brigade members who are expected to perform interior structural fire fighting. The standard references the publications as the chief sources of information for determining if the protective clothing affords the required level of protection.

It is appropriate to note that the final standard does not require employers to purchase a copy of the referenced publications. Instead, employers can specify (in purchase orders to the manufacturers) that the protective clothing meet the criteria and test methods contained in the referenced publications and can rely on the manufacturers assurances of compliance. Employers, however, may desire to obtain a copy of the referenced publications for their own information.

The section designation of the standard where the referenced publications appear, the title of the publications, and the availability of the publications are as follows:

Section Designation	Referenced Publication	Available From
WAC 296-24-58513 (3)(b)	"Protective clothing for Structural Fire Fighting." NFPA No. 1971 (1975)	National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9101.
WAC 296-24-58513(4)(a)	"Development of Criteria for Fire Fighter's Gloves; Vol. II, Part II: Test Methods." (1976)	U.S. Government Printing Office, Washington, D.C. 20401. Stock No. for Vol. II is: 071-033-021-1
WAC 296-24-58513(5)(a)	"Model Performance Criteria for Structural Firefighter's Helmet" (1977)	U.S. Fire Administration, National Safety and Research Office, 16825 South Seton Avenue, Emmitsburg, Maryland 21727

The referenced publications (or a microfiche of the publications) are available for review at many universities and public libraries throughout the country. These publications may also be examined at the OSHA Technical Data Center, Room N2439-Rear, United States Department of Labor, 200 Constitution Avenue Northwest, Washington, D.C. 20210 (202-523-9700), or at any OSHA Regional Office (see telephone directories under United States Government-Labor Department).

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-63499, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-24-63499, filed 12/24/81.]

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**WAC 296-24-63599 Appendix E-Test methods for protective clothing.** This appendix contains test methods which must be used to determine if protective clothing affords the required level of protection as specified in WAC 296-24-58505 - fire brigades.

- (1) Puncture resistance test method for foot protection.
  - (a) Apparatus. The puncture resistance test shall be performed on a testing machine having a movable platform adjusted to travel at one-quarter-inch per minute (0.1 cm/sec). Two blocks of hardwood, metal, or plastic shall be prepared as follows: The blocks shall be of such size and thickness as to insure a suitable rigid test ensemble and allow for at least one-inch of the pointed end of an 8D nail to be exposed for the penetration. One block shall have a hole drilled to hold an 8D common nail firmly at an angle of 98°. The second block shall have a maximum one-half inch (1.3 cm) diameter hole drilled through it so that the hole will allow free passage of the nail after it penetrates the insole during the test.
  - (b) Procedure. The test ensemble consisting of the sample unit, the two prepared blocks, a piece of leather outsole ten to eleven irons thick and a new 8D nail, shall be placed as follows: The 8D nail in the hole, the sample of outsole stock superimposed above the nail, the area of the sole plate to be tested placed on the outsole, and the second block with hole so placed as to allow for free passage of the nail after it passes through the outsole stock and sole plate in that order. The machine shall be started and the pressure, in pounds required for the nail to completely penetrate the outsole and sole plate, recorded to the nearest five pounds. Two determinations shall be made on each sole plate and the results averaged. A new nail shall be used for each determination.
  - (c) Source. These test requirements are contained in "Military Specification For Fireman's Boots," MIL-B-2885D (1973 and amendment dated 1975) and are reproduced for your convenience.
- (2) Test method for determining the strength of cloth by tearing: Trapezoid method.
  - (a) Test specimen. The specimen shall be a rectangle of cloth three-inches by six-inches (7.6 cm by 15.2 cm). The long dimension shall be parallel to the warp for warp tests and parallel to the filling for filling tests. No two specimens for warp tests shall contain the same warp yarns, nor shall any two specimens for filling tests contain the same filling yarns. The specimen shall be taken no nearer the selvage than 1/10 the width of the cloth. An isosceles trapezoid having an altitude of three inches (7.6 cm) and bases of one inch (2.5 cm) and four inches (10.2 cm) in length, respectively, shall be marked on each specimen, preferably with the aid of a template. A cut approximately three-eighths inch (1 cm) in length shall then be made in the center of a perpendicular to the one inch (2.5 cm) edge.
  - (b) Apparatus.
    - (i) Six-ounce (.17 kg) weight tension clamps shall be used so designed that the six ounces (.17 kg) of weight are distributed evenly across the complete width of the sample.
    - (ii) The machine shall consist of three main parts: Straining mechanism, clamps for holding specimen, and load and elongation recording mechanisms.
    - (iii) A machine wherein the specimen is held between two clamps and strained by a uniform movement of the pulling clamp shall be used.
    - (iv) The machine shall be adjusted so that the pulling clamp shall have a uniform speed of 12 ± 10.5 inches per minute (0.5 ± .02 cm/sec).

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- (v) The machine shall have two clamps with two jaws on each clamp. The design of the two clamps shall be such that one gripping surface or jaw may be an integral part of the rigid frame of the clamp or be fastened to allow a slight vertical movement, while the other gripping surface or jaw shall be completely moveable. The dimension of the immovable jaw of each clamp parallel to the application of the load shall measure one inch, and the dimension of the jaw perpendicular to this direction shall measure three inches or more. The face of the moveable jaw of each clamp shall measure one inch by three inches.

Each jaw face shall have a flat, smooth, gripping surface. All edges which might cause a cutting action shall be rounded to a radius of not over 1/64 inch (.04 cm). In cases where a cloth tends to slip when being tested, the jaws may be faced with rubber or other material to prevent slippage. The distance between the jaws (gage length) shall be one inch at the start of the test.

- (vi) Calibrated dial; scale or chart shall be used to indicate applied load and elongation. The machine shall be adjusted or set, so that the maximum load required to break the specimen will remain indicated on the calibrated dial or scale after the test specimen has ruptured.
- (vii) The machine shall be of such capacity that the maximum load required to break the specimen shall be not greater than eighty-five percent or less than fifteen percent of the rated capacity.
- (viii) The error of the machine shall not exceed two percent up to and including a fifty-pound load (22.6 kg) and one percent over a fifty-pound load (22.6 kg) at any reading within its loading range.
- (ix) All machine attachments for determining maximum loads shall be disengaged during this test.

(c) Procedure.

- (i) The specimen shall be clamped in the machine along the nonparallel sides of the trapezoid so that these sides lie along the lower edge of the upper clamp and the upper edge of the lower clamp with the cut halfway between the clamps. The short trapezoid base shall be held taut and the long trapezoid base shall lie in the folds.
- (ii) The machine shall be started and the force necessary to tear the cloth shall be observed by means of an autographic recording device. The speed of the pulling clamp shall be 12 inches  $\pm$  0.5-inch per minute (0.5  $\pm$  .02 cm/sec).
- (iii) If a specimen slips between the jaws, breaks in or at the edges of the jaws, or if for any reason attributable to faulty technique, an individual measurement falls markedly below the average test results for the sample unit, such result shall be discarded and another specimen shall be tested.
- (iv) The tearing strength of the specimen shall be the average of the five highest peak loads of resistance registered for three inches (7.6 cm) of separation of the tear.

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**WAC 296-24-63599 (Cont.)**

- (d) Report.
    - (i) Five specimens in each of the warp and filling direction shall be tested from each sample unit.
    - (ii) The tearing strength of the sample unit shall be the average of the result obtained from the specimens tested in each of the warp and filling directions and shall be reported separately to the nearest 0.1 pound (.05 kg).
  - (e) Source. These test requirements are contained in “Federal Test Method Standard 191, Method 5136,” and are reproduced for your convenience.
- (3) Test method for determining flame resistance of cloth; vertical.
- (a) Test specimen. The specimen shall be a rectangle of cloth two and three-quarter inches (7.0 cm) by twelve inches (30.5 cm) with the long dimension parallel to either the warp or filling direction of the cloth. No two warp specimens shall contain the same warp yarns, and no two filling specimens shall contain the same filling yarn.
  - (b) Number of determinations. Five specimens from each of the warp and filling directions shall be tested from each sample unit.
  - (c) Apparatus.
    - (i) Cabinet. A cabinet and accessories shall be fabricated in accordance with the requirements specified in Figures L-1, L-2, and L-3. Galvanized sheet metal or other suitable metal shall be used. The entire inside back wall of the cabinet shall be painted black to facilitate the viewing of the test specimen and pilot flame.
    - (ii) Burner. The burner shall be equipped with a variable orifice to adjust the flame height, a barrel having a three-eighth inch (9.5 mm) inside diameter and a pilot light.
      - (A) The burner may be constructed by combining a three-eighth inch (1 cm) inside diameter barrel  $3 \pm 1/4$ -inches ( $7.6 \pm .6$  cm) long from a fixed orifice burner with a base from a variable orifice burner.
      - (B) The pilot light tube shall have a diameter of approximately one-sixteenth inch (.2 cm) and shall be spaced one-eighth inch (.3 cm) away from the burner edge with a pilot flame one-eighth inch (.3 cm) long.
      - (C) The necessary gas connections and the applicable plumbing shall be as specified in Figure L-4 except that a solenoid valve may be used in lieu of the stopcock valve to which the burner is attached. The stopcock valve or solenoid valve, whichever is used, shall be capable of being fully opened or fully closed in 0.1 second.
      - (D) On the side of the barrel of the burner, opposite the pilot light there shall be a metal rod of approximately one-eighth inch (.3 cm) diameter spaced one-half inch (1.3 cm) from the barrel and extending above the burner. The rod shall have two five-sixteenth inch (.8 cm) prongs marking the distances of three-quarters inch (1.9 cm), and one and one-half inches (3.8 cm) above the top of the burner.

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- (E) The burner shall be fixed in a position so that the center of the barrel of the burner is directly below the center of the specimen.
- (iii) There shall be a control valve system with a delivery rate designed to furnish gas to the burner under a pressure of  $2\frac{1}{2} \pm \frac{1}{4}$  (psi) ( $17.5 \pm 1.8$  kPa) at the burner inlet. The manufacturer's recommended delivery rate for the valve system shall be included in the required pressure.
- (iv) A synthetic gas mixture shall be of the following composition within the following limits (analyzed at standard conditions):  $55 \pm 3$  percent hydrogen,  $24 \pm 1$  percent methane,  $3 \pm 1$  percent ethane, and  $18 \pm 1$  percent carbon monoxide which will give a specific gravity of  $0.365 \pm 0.018$  (air = 1) and a B.T.U. content of  $540 \pm 20$  per cubic foot ( $20.1 \pm 3.7$  kJL) (dry basis) at 69.8 F (21 C).
- (v) There shall be metal hooks and weights to produce a series of total loads to determine length of char. The metal hooks shall consist of No. 19 gage steel wire or equivalent and shall be made from three inch (7.6 cm) lengths of wire and bent one-half inch (1.3 cm) from one end to a 45-degree hook. One end of the hook shall be fastened around the neck of the weight to be used.
- (vi) There shall be a stop watch or other device to measure the burning time 0.2 second.
- (vii) There shall be a scale, graduated in 0.1 inch (.3 cm) to measure the length of char.
- (d) Procedure.
  - (i) The material undergoing test shall be evaluated for the characteristics of after-flame time and char length on each specimen.
  - (ii) All specimens to be tested shall be at moisture equilibrium under standard atmospheric conditions in accordance with subsection (3)(c) of this appendix. Each specimen to be tested shall be exposed to the test flame within twenty seconds after removal from the standard atmosphere. In case of dispute, all testing will be conducted under standard atmospheric conditions in accordance with subsection (3)(c) of this appendix.
  - (iii) The specimen in its holder shall be suspended vertically in the cabinet in such a manner that the entire length of the specimen is exposed and the lower end is three-quarters inch (1.9 cm) above the top of the gas burner. The apparatus shall be set up in a draft-free area.
  - (iv) Prior to inserting the specimen, the pilot flame shall be adjusted to approximately one-eighth inch (.3 cm) in height measured from its lowest point to the tip.

The burner flame shall be adjusted by means of the needle valve in the base of the burner to give a flame height of one and one-half inches (3.8 cm) with the stopcock fully open and the air supply to burner shut off and taped. The one and one-half inch (3.8 cm) flame height is obtained by adjusting the valve so that the uppermost portion (tip) of the flame is level with the tip of the metal prong (see Fig. L-2) specified for adjustment of flame height. It is an important aspect of the evaluation that the flame height to be adjusted with the tip of the flame level with the tip of the metal prong. After inserting the



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specimen, the stopcock shall be fully opened, and the burner flame applied vertically at the middle of the lower edge of the specimen for twelve seconds and the burner turned off. The cabinet door shall remain shut during testing.

- (v) The after-flame shall be the time the specimen continues to flame after the burner flame is shut off.
- (vi) After each specimen is removed, the test cabinet shall be cleared of fumes and smoke prior to testing the next specimen.
- (vii) After both flaming and glowing have ceased, the char length shall be measured. The char length shall be the distance from the end of the specimen, which was exposed to the flame, to the end of a tear (made lengthwise) of the specimen through the center of the charred area as follows: The specimen shall be folded lengthwise and creased by hand along a line through the highest peak of the charred area. The hook shall be inserted in the specimen (or a hole, one-quarter inch (.6 cm) diameter or less, punched out for the hook) at one side of the charred area one-quarter inch (.6 cm) from the adjacent outside edge and one-quarter inch (.6 cm) in from the lower end. A weight of sufficient size such that the weight and hook together shall equal the total tearing load required in Table L-2 of this section shall be attached to the hook.
- (viii) A tearing force shall be applied gently to the specimen by grasping the corner of the cloth at the opposite edge of the char from the load and raising the specimen and weight clear of the supporting surface. The end of the tear shall be marked off on the edge and the char length measurement made along the undamaged edge.

Loads for determining char length applicable to the weight of the test cloth shall be as shown in Table L-2.

**TABLE L-2**

<b>Specified weight per square yard of cloth before any fire retardant treatment or coating - ounces</b>	<b>Total learning weight for determining the charred length - pound</b>
2.0 to 6.0	0.25
Over 6.0 to 15.0	0.50
Over 15.0 to 23.0	0.75
Over 23.0	1.0

To change into S.I. (System International) units, 1 ounce = 28.35 grams, 1 pound = 453 grams, 1 yard = .91 metre.

- (ix) The after-flame time of the specimen shall be recorded to the nearest 0.2 second and the char length to the nearest 0.1 inch (.3 cm).
- (e) Report.
  - (i) The after-flame time and char length of the sample unit shall be the average of the results obtained from the individual specimens tested. All values obtained from the individual specimens shall be recorded.
  - (ii) The after-flame time shall be reported in the nearest 0.2 second and the char length to the nearest 0.1 inch (.3 cm).
- (f) Source. These test requirements are contained in "Federal Test Method Standard 191, Method 5903 (1971)," and are reproduced for your convenience.

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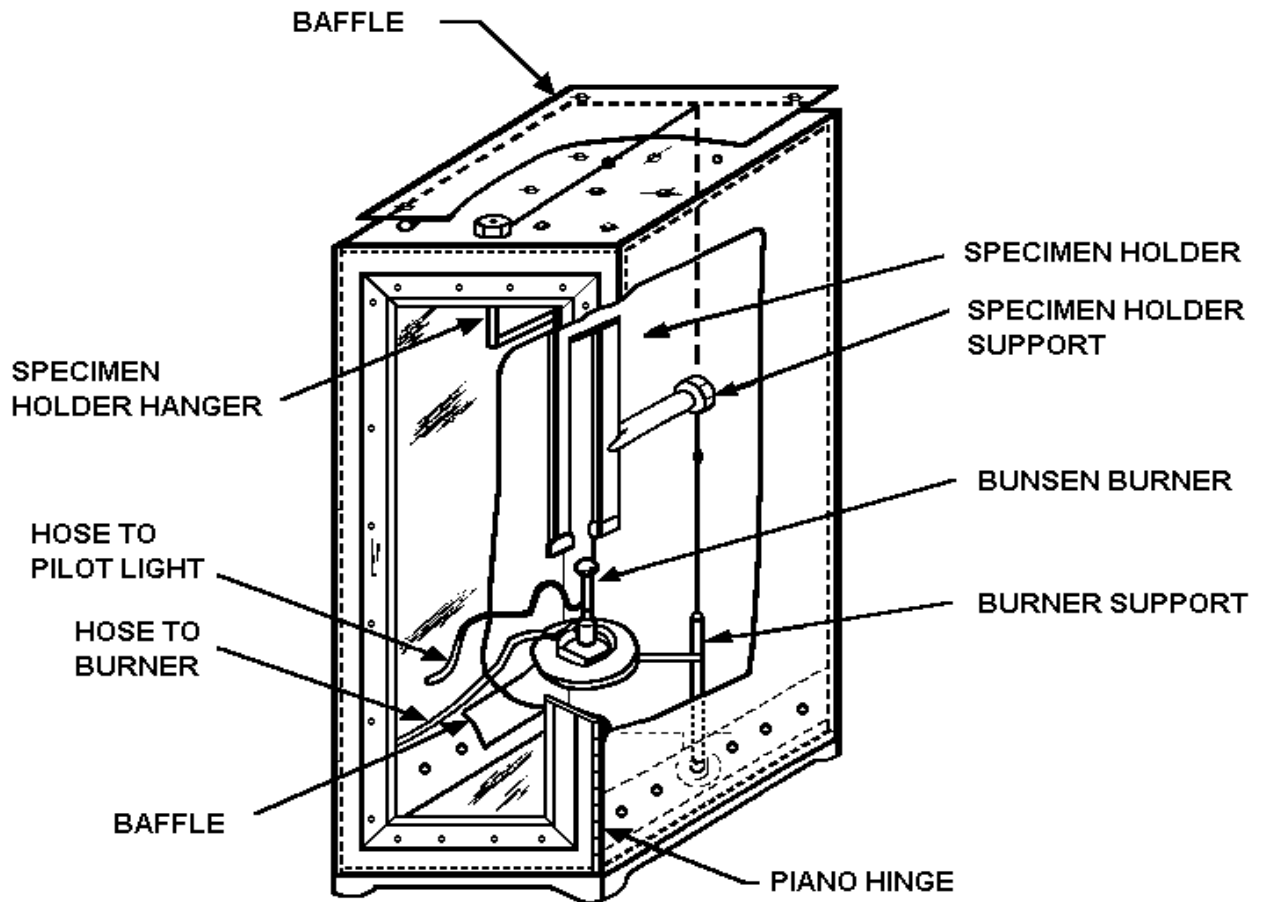


Figure L-1 - Vertical flame resistance textile apparatus. All given dimensions are in inches. System International (S.I.) unit: 1 inch = 2.54 cm.

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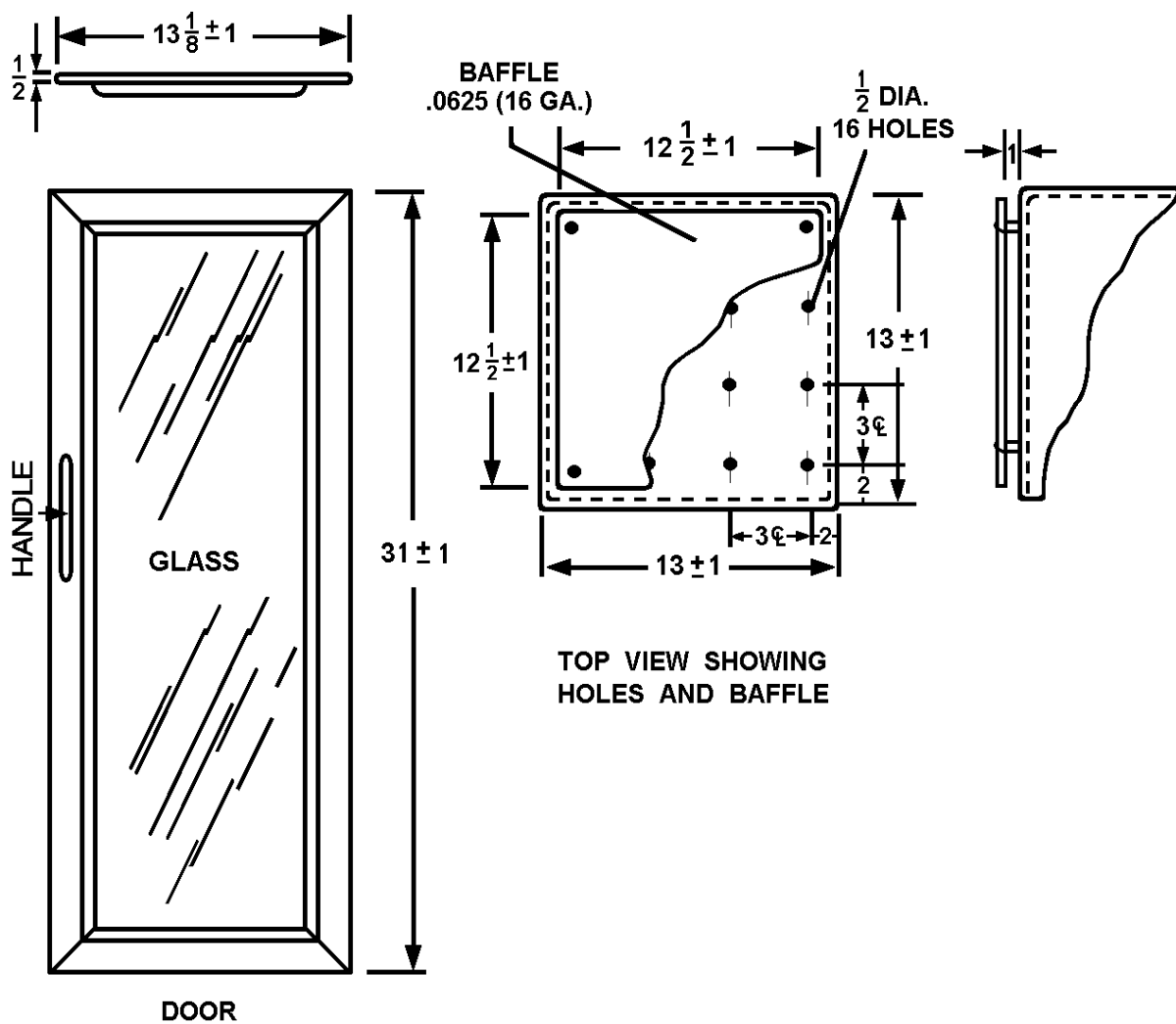


Figure L-2 - Vertical flame resistance textile apparatus, door and top view w/baffle. All given dimensions are in inches. System International (S.I.) unit: 1 inch = 2.54 cm.

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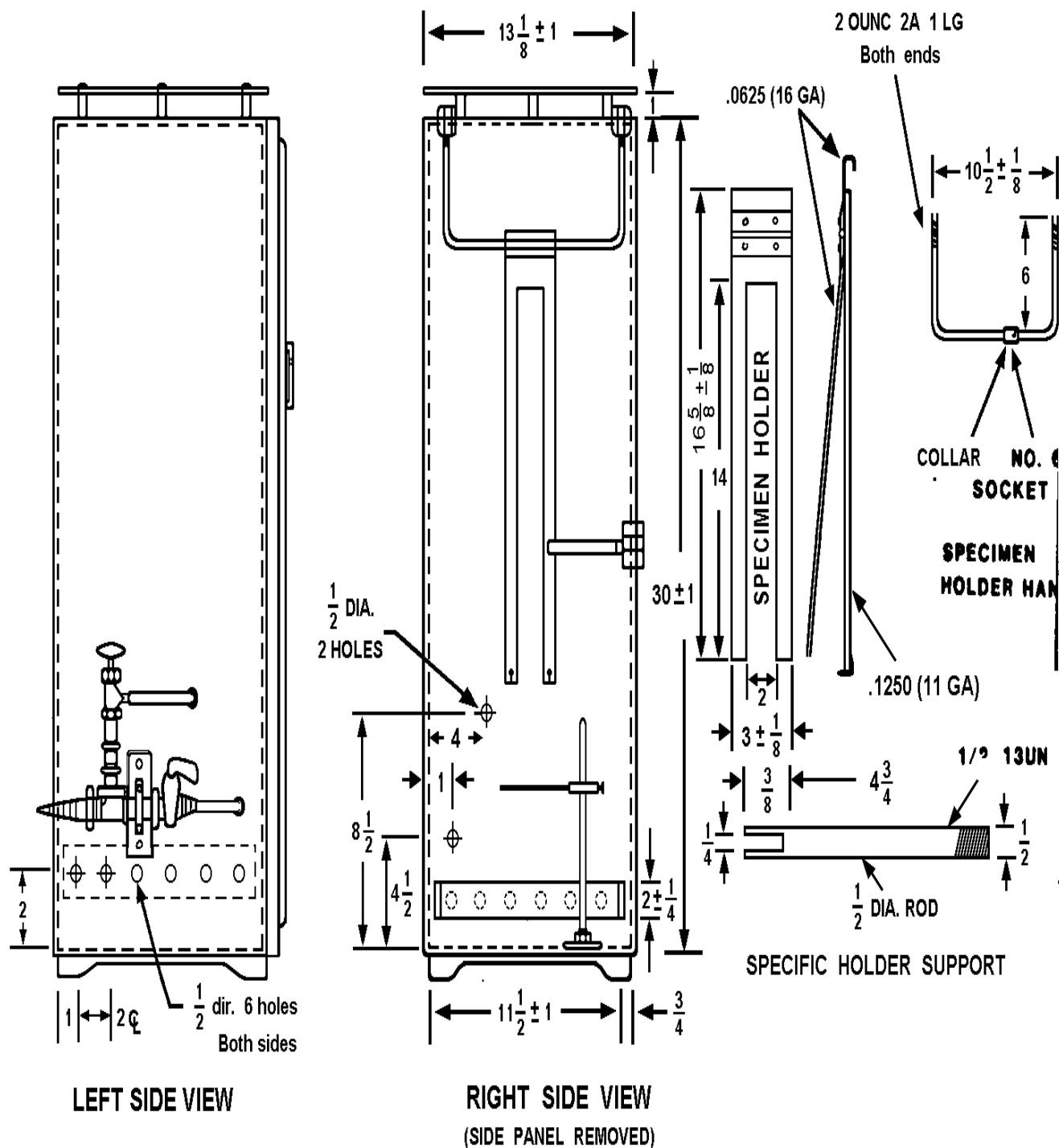


Figure L-3 - Vertical flame resistance textile apparatus, views and details. All given dimensions are in inches. System International (S.I.) unit: 1 inch = 2.54 cm.

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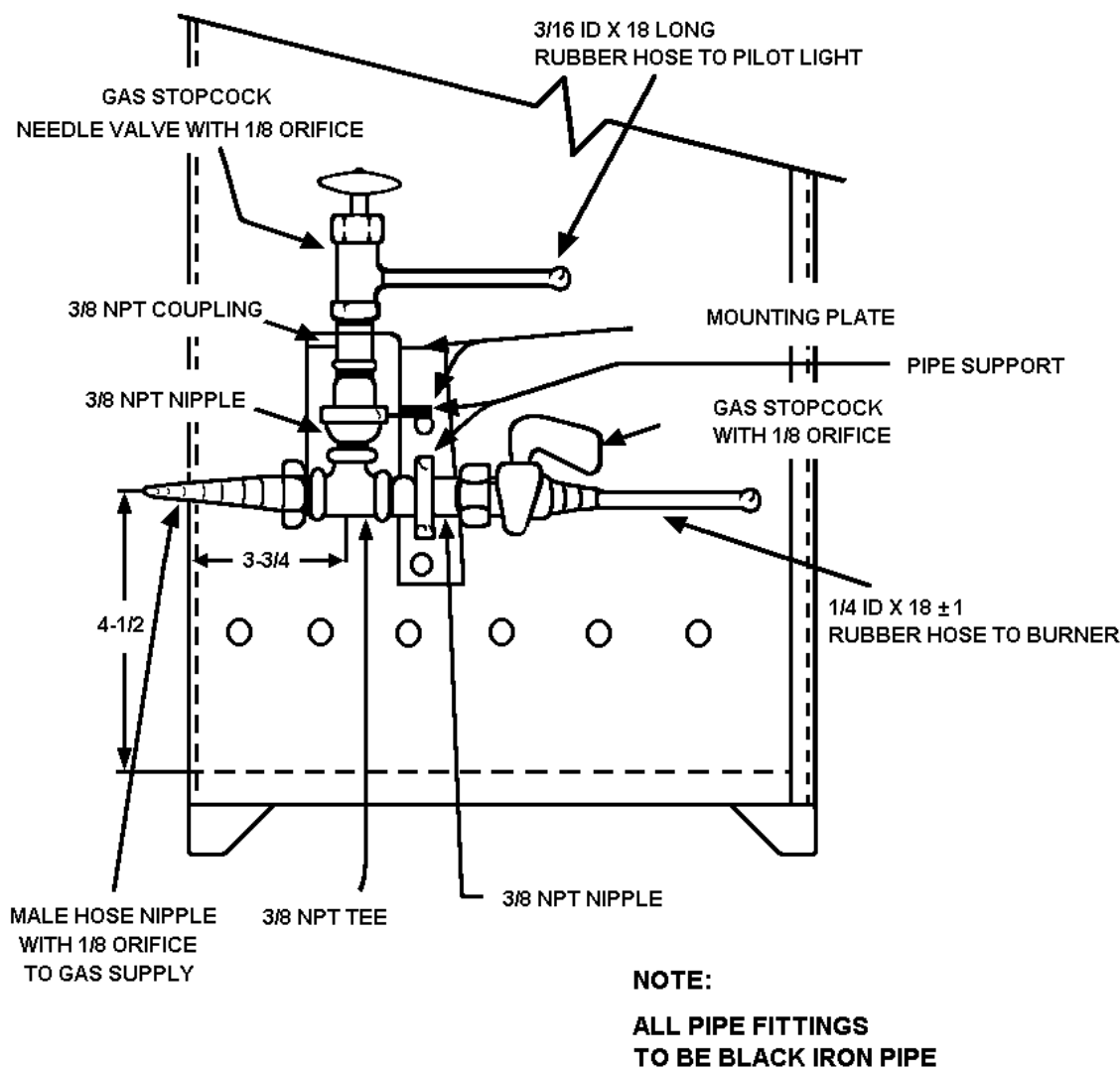


Figure L-4 - Vertical flame resistance textile apparatus (side view showing gas hose connection.) All given dimensions are in inches. System International (S.I.) unit: 1 inch = 2.54 cm.

[Statutory Authority: Chapter 49.17 RCW. 92-23-017 (Order 92-13), § 296-24-63599, filed 11/02/92, effective 12/18/92; 87-24-051 (Order 87-24), § 296-24-63599, filed 11/30/87. Statutory Authority: RCW.49.17.040 and 49.17.052. 82-02-003 (Order 81-32), § 296-24-63599, filed 12/24/81.]